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ABSTRACT

Issues related to design and implementation of Computer Assisted Learning (CAL) programs on the university level are discussed. First, three points are noted that affect the way materials are conceived: the type of user and the way of giving choices regarding exercises, the fact that the computer is primarily a medium adapted to the written word, and the adaptability of the equipment to be used. Secondly, vital ingredients in the design of a CAL lesson are presented: the questions to be answered, the format that is most adaptable to the point in question, the desirability of contextualization, user-aid features to be included, and provision for error analysis and feedback. A third section deals with examples of CAL materials created at the University of Western Ontario. These range from a translation-based drill and practice review of vocabulary to a contextualized drill. Both of these were designed for teletype terminals. A second example of CAL lessons is one on numbers and dates that was designed for use with color microcomputers. The final section of the paper deals with the place such a system should be given in the curriculum, that is, whether it should be responsible for instruction in certain aspects of the course or whether it should have a solely adjunctive role. Finally, human factors such as faculty attitudes and the part they play are discussed. (AMH)

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Computer-Assisted Learning: Design and Implementation

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Although the media is constantly informing us that computers are becoming a facet of our daily lives, and despite the ever-increasing use of computers in education, the simple fact is that the computer has, at present, very little impact on the teaching and learning of modern languages. In a recent article published in the *Modern Language Journal* (Olsen, 1980) it was revealed that in only ten per cent of American four-year colleges was computer-assisted instruction being used. Other studies (Moursund, 1979) have pointed out, quite rightly, that particularly in the elementary and secondary school systems, CAL is having almost no impact on most students. Yet there is a decidedly growing interest in CAL in modern languages. Proof of this is seen in the growing number of publications related to the topic, and in the similarly increasing number of institutions, in Canada and elsewhere, which are producing courseware. In addition, at our own CAL facility at the University of Western Ontario we have received numerous inquiries and visits from interested individuals in the past few years.

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The reason for this interest is obvious: there is a growing belief in the potential of the computer for the learning of foreign languages. As is confirmed in the survey by Olsen, most people who have been actively involved in CAL would agree that the computer can play a significant role in modern language departments. However, before this potential can be fully realized and in order for CAL to be truly effective there are two major areas of concern that should be considered carefully: the need to design pedagogical materials that successfully

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exploit the medium of the computer; and secondly, the intelligent implementation of this new technology into the existing system of education.

During the first part of this workshop we would like to offer some thoughts as to how these problems of design and implementation might be approached.

Design

In the first part of our talk devoted to design we should like to raise three preliminary points that can affect the way materials are conceived: the user, the medium, and the type of hardware delivery system. We shall then proceed to discuss some vital ingredients of a CAL lesson and offer some examples of materials designed at the University of Western Ontario.

The Nature of the User

An important question which should be asked prior to the creation of CAL materials is: Who are your prospective users? Many early CAL materials, and even some currently being designed, are intended for use by students within a particular institution. Given the need for relevancy to the student's immediate concerns—usually a mark on an upcoming exam—the temptation is to make the materials pertinent only when used in conjunction with a particular grammar manual. The temptation is even stronger when creating materials for introductory language courses where a major problem is the sequencing of lexical and grammatical units. For example, there is no point in a student doing a unit on the agreement of adjectives if he has not yet studied gender; similarly, the student must have had prior exposure to the vocabulary used in any given unit. These problems can be easily overcome by linking the CAL program to the particular grammar text the student is using. On the other hand, the disadvantages are clear. The materials may be useless when the text is changed, and—perhaps just as important given the interest others may have in acquiring ready-made courseware—they may not be readily adaptable to the situation in other institutions.

A related problem to be faced concerns the ability range of the intended user. If a coursewriter wishes to create materials that will attract all of a given set of students, he must take stock of the different needs of the advanced student and the slower student. The advanced student has become so by succeeding with traditional modes of learning. In our experience he is likely to see the exercises on a computer simply as a challenge. He will pit himself against the machine, and his main interest is in obtaining the best score possible. He is less interested in remedial messages or any other feature which will make him deviate from his goal. On the other hand, the remedial student who has not succeeded with traditional methods may well approach the computer with a contrary attitude (Kidd & Holmes, 1980). In this situation the computer is sometimes viewed as a friend who does not exert the kind of peer pressure found in the classroom, and who can display infinite patience. The coursewriter must, to create materials that will be effective for this student, include in his program as much remedial information as may be required, and offer the possibility of repeated attempts to answer a question.

The two situations are at opposite ends of the spectrum but, unless the coursewriter is willing to limit the applicability of his program, the two must be reconciled. In reality, the reconciliation can be made relatively simply. The student can be given choices of which exercises to do, of when he can exit from a portion of the program, of requesting supplementary information when necessary, etc. Lock-step progressions and automatic branching may perhaps seem good ideas in theory; in practice they can deter both advanced and remedial students.

The Nature of the Medium

Before beginning to design lessons the coursewriter should be well aware of the limitations of the computer and have a clear idea of the linguistic skills it is best suited to promote. For example, we were once giving a demonstration of our CAL materials at the Ontario Ministry of Education when one educator criticized our programs because they were not oral; there was no sound. This fact was patently obvious, but the mistake that this educator made was to approach CAL with a preconceived notion of what it should be doing; namely,

reflecting his own priorities as regards the linguistic skills to be taught without any consideration for the limitations imposed by technology.

This does not mean that computers cannot mediate the spoken word. The audio feature, however, is not inherent to the computer and, if we are to use real speech, involves the use of peripheral equipment such as audio cassettes. As yet, the computer does not recognize a wide range of sounds and can speak and interpret speech in a very primitive manner totally unsuitable for language training.

The computer, then, most easily adapts itself to the written word and therefore the linguistic skills that depend on the written word. Most existing CAL programs for foreign languages concentrate on vocabulary, grammar, syntax and, to a lesser extent, reading comprehension. Such limitations should in no way deter the coursewriter since these skills are fundamental to second language acquisition. Moreover, as some coursewriters are beginning to demonstrate, it is possible to devise excellent pedagogical exercises to develop these skills, even with a relatively unsophisticated computer program (Collett, 1980; Farrington, 1981).

The Equipment

All computers have certain things in common: they can retrieve and present information; they can manipulate data; they are interactive and can respond to input. There are, however, great differences in computer systems, and the variations in features offered by the different types of systems can have extensive repercussions on the nature of the programs that the coursewriter can develop. We should like to discuss briefly the two main types of systems and the features that they make available for exploitation by the coursewriter.

The first hardware configuration, the teletype or the (non-graphic) cathode ray terminal attached to a mainframe computer was virtually the only type of configuration available to the coursewriter until recently. Our own facility began with four such terminals. The technical features that the configuration offers the coursewriter are relatively limited. The teletype terminal restricts us to a linear, print-oriented medium. Words, lines of print, must follow each other, there is no overstrike capability, there is no erase feature—whatever is printed, including student typing errors, remains printed. The means

of emphasizing are limited to capitalization and underlining. There is no way of clearly delineating between one frame and the next; unless the computer is made to skip several spaces the text appears to be totally continuous. The coursewriter is therefore faced with a totally undynamic medium, one which, at least in terms of the visual layout of the information on the paper, is little different from the traditional technology of the book.

On the other hand the microcomputer is a totally different medium, and offers an expanded range of technical features which may be at once the joy and the despair of the coursewriter (Holmes & Kidd, 1980). The micro is a visual medium by no means committed to the static, linear presentation of print. Whatever is placed on the screen can be moved, in any direction, either quickly or slowly. Characters can be added, or removed. Portions of the screen can be divided off and manipulated independently. The graphics capability means that the coursewriter can create images to either supplement, or replace, text. The micro offers an overstrike capability allowing the cursor to be moved at will to any part of the screen, permitting modifications to be made. At the University of Western Ontario we have, for the past three years, been using colour micros, and we therefore have enjoyed the added dimension of colour—a feature which will in time doubtless be incorporated into all microcomputers.

The coursewriter, before he begins to design any lesson, must be familiar with the features offered by his particular computer, and at once work within its limitations and exploit its potential. Whatever the computer, it has unique features that are not shared by any other form of technology, and the imaginative coursewriter will be prepared to rethink the language learning process in terms of this new medium. One of the gravest errors would be to fail to appreciate and exploit these capabilities.

Lesson Contents

The Presentation of Information

Part of any CAL lesson will usually involve the presentation of information to the student. The task of the coursewriter is to impart that information in the most effective way possible, bearing in mind the technical features of the machine that will be acting as interme-

diary. The teletype of course offers limited possibilities, but if consideration is not given to spacing and organization of material, communication can be seriously impaired. When using a colour micro, on the other hand, there are a variety of features, all of which can and should be used to help reinforce the textual message. Graphics, colour, screen management, simulated movement can all assist in creating striking visual representations of grammatical or syntactical points. In addition to elucidating the ideas to be conveyed, the use of a more visual approach also introduces greater diversity into the presentation and helps sustain user interest and motivation. This particular element of courseware design is of vital pedagogical importance and should not be overlooked.

The Testing of Student Competence

A lesson will normally be comprised of a number of questions to be answered in order to test the student's competence. Several formats come readily to mind—multiple choice, fill-ins, semantic matching, cloze testing etc.—and undoubtedly others can be created. The choice of format should not be left to chance or inertia but should be that which adapts itself most readily to the grammar point in question. Other matters for consideration include the desirability of contextualization of elements within each question. Furthermore, a decision should be made concerning the possibility of having all sentences in an exercise refer to a common situation rather than remaining semantically independent. Finally the coursewriter will have to decide what aid features, if any, should be made available to the student who is experiencing difficulty completing the exercise correctly.

Analysis of Student Input and Feedback

An extremely important aspect of CAL lesson design—particularly if used for remedial work—is error analysis and feedback. This facet of the lesson is often invisible as the analysis will only occur in response to an error, but it can consume an enormous amount of time and energy. The coursewriter must decide how detailed he wishes the analysis to be and what form the subsequent feedback will take. For example, when checking even a one-word answer, shall the computer analyze it as a whole, break it into its grammatically significant parts, or check each character individually? Does the coursewriter want the computer to search for specific errors he antici-

pates the student will make, or should all incorrect answers receive the same stock response? Is a missing accent important? What about typing errors committed inadvertently? Will attempts be made to distinguish errors of competence from errors of performance? If the student demonstrates progress, should he be allowed to try again? How is progress determined? At what point is the correct answer to be given? What form should feedback on errors take? Will it be enough to merely flag the error or should more information be given? Is it better to explain why the answer is incorrect or try to give hints as to what the correct answer might be? Later in this workshop we shall try to give you all a chance to determine how you might answer the above questions.

Examples: U.W.O. Materials

We should like to illustrate briefly some of the CAL materials that we created at the University of Western Ontario, firstly for the mainframe-teletype configuration, and secondly for the colour micro. In so doing we shall try to sketch the evolution of the CAL facility in terms of both the design of courseware and the hardware used.

Our initial programs were designed to run on teletype terminals. Our first effort, ELVOC, was a translation-based drill-and-practice review of vocabulary. The courseware design was unvaried and somewhat uninspiring. The basic procedure had only three steps: the computer provided an English stimulus, the student typed in an answer, and the computer responded with a reinforcement. This procedure was repeated for the total number of working items, sometimes up to fifty or sixty. The items were divided into two sections, depending on their importance, and in the second section, containing the more difficult items, the students had the option of translating from French into English. In sum, the program was little more than a printed list of words, its merit being that it provided the student with an opportunity to test his knowledge of French vocabulary.

A second program, DEFTE, was also a vocabulary drill designed for the teletype configuration (Holmes, 1980). This program displayed, however, a little more imagination in terms of the pedagogical content, branching procedures and visual layout. The student had to find a French word or expression based on the context provided, usually one or two sentences. Should he require help, he could request a definition of the missing term, and if he made a typing error the

program could usually pinpoint this. For variation, and to offer a greater challenge, some contexts required the student to find two missing words or expressions. Each lesson was divided into three or four distinct units, and each unit contained no more than ten contexts. One question was clearly divided from the next by three asterisks so as to give some visual indication of moving from one frame to the next.

It was, however, only when we began using colour microcomputers that we were given a stiff challenge in terms of the kind of courseware that we could design. In 1978 we joined colleagues at the Universities of Guelph and Waterloo, and last year at the University of Calgary, to create a series of lessons at the introductory level, using equipment manufactured by Intelligent Systems Corporation. The project was called CLEF (Computer-assisted Learning Exercises for French). Perhaps the best way of illustrating how we responded to the challenge is to discuss one of our lessons, devoted to Numbers and Dates.

The CLEF lessons are designed to be text-independent, pertinent to virtually all students at the introductory level. They are conceived as a supplement to traditional teaching and learning methods, and the assumption is made that the student has had at least some prior exposure to the grammatical points covered. Each lesson is divided into two distinct parts: firstly, the student has the option of reviewing the grammar point; secondly, he moves on to the drill-and-practice exercises.

In presenting a brief review of the grammar point, we have divided the material into a series of frames. In each frame we have attempted to avoid two major pitfalls: firstly, that of presenting too much information on the screen at the same time; and secondly, that of making indiscreet use of the eight colours which ISC offers. Either can, we have found, seriously impair the user's ability to pinpoint and assimilate the essential information.

Our first frame in this lesson begins with one sentence of text, concerning the number *one* and its two French forms *un/une*. We have then, as in most of our grammar explanations, attempted to give a visual reinforcement of the concepts involved, and to do so in as visually striking a manner as possible. Hence, *un* is printed and a single bird flies onto the screen. The word *oiseau* appears beside

un. Then the word *une* appears, and a house is drawn on the screen. The word *maison* takes its place beside the article. The student must then press RETURN to continue, a feature we use extensively to encourage self-pacing.

The first frame is subsequently modified, as we take advantage of the ability to split the micro screen into sub-portions. We replace the original text with another referring to the numbers from two to ten, and invite the student to count aloud, as nine more birds fly onto the screen to alight on the roof of the house. With each successive bird the French number changes. In this way we have sought to stimulate user interest in the material, and at the same time highlight the essential grammatical points to be assimilated.

In a later series of frames and sub-frames we visualize the concepts involved in counting; that is, some elements remain while others change. Firstly, the nine appropriate numbers are appended to *vingt*. To illustrate how the thirties are formed, we retain the nine suffixed numbers, remove *vingt*, and simply replace it with *trente*.

In the sequence dealing with months, each month is accompanied by a small graphic illustrating a feature typical of that time of the year. Winter is symbolized by a gradually disappearing snowman, Spring by the growth and blossoming of flowers, Summer by a hot sun, and Autumn by falling leaves. The graphics here have no specific pedagogical purpose other than as a motivator. The results of our field-tests have shown that the lesson has had considerable success in this regard.

In the final sequence of frames in this section the student is told and shown how to express dates, and in the process we combine two features available on the micro: the simultaneous manipulation of two areas of the screen, and the ability to scroll letters onto the screen at a variety of controlled speeds. The expression of dates comprises three elements: (i) the article, (ii) the number, (iii) the month. The textual message pauses after the first element, while the article is scrolled onto the screen by way of illustration. Similarly with the other two elements. The advantages are that the student can see each element illustrated as it is explained, and the scrolling of letters, simulating writing speed, attracts the student's attention while giving him enough time to follow what is happening.

At the completion of the review the student is given a choice of exercises. Each of the exercises is preceded by the presentation of the major lexical items that he will encounter during the exercise. Thus, whatever grammar text he happens to be using, the student will not be hampered by vocabulary problems. In this section we have coloured all nouns either blue or red, according to gender, as a mnemonic device. This is also consistently done in many gender-related units. However, we have not yet conducted tests to see just how successful this technique might be. The student can request a translation of any French item and, using the micro's timing capabilities, the English equivalent appears for some three seconds opposite the French. In this way, the English, which is of course not our major concern, is not permanent but serves only as a transitory aid.

The drill and practice exercises, of which there are three or four to a lesson, take into account the student's need to develop both mechanical skills and the ability to apply such skills in a semantically meaningful way. The exercises are thus graded according to difficulty and the better student may skip the earlier exercises and move directly to the most challenging. In addition to varying the linguistic demands made in each exercise, we have also followed the principle of varying the actual formats of exercises so as to counteract the ever-present possibility of user boredom.

The first of our exercises on numbers merely requires the student to perform a simple mathematical operation and type the appropriate number. In this exercise, as in all others, the error messages are timed and, when the student is given a second opportunity, there remains no trace of his original error on the screen. The second exercise requires the student to type in the three elements to express the date, the stimulus being a calendar with a number highlighted in green. In such multiple word input exercises, where the student may make an insignificant spacing error, the error can be flagged and automatically corrected on the screen. An orthographical error can be signalled by underlining the offending characters. The third exercise, identified as a numbers game, attempts to live up visually to this designation. Whilst drilling the student's ability to type the written response to mathematical equations, the answer to each problem moves across the screen to become the beginning of the next question. The final exercise, as in all the CLEF lessons, tests both mechanical and semantic skills by means of contextualized sentences. The only clue to the answer

is the context itself. Usually, at this point, we introduce few novel features; the intellectual challenge of the exercise provides stimulus enough.

Implementation

In this final section of our paper we should like to raise certain questions that may be of concern to those educators who are considering implementing a CAL system—either ready-made, or of their own creation. The two major elements for consideration are the place that such a system should be given in the curriculum and the human factors that might facilitate or impede the implementation process.

The Place in The Curriculum

Nobody would claim that the computer can be used as the sole source of instruction in a language course designed to teach the mastery of all linguistic skills. Given the present state of technology the computer is unable to provide practice in spontaneous verbal interaction. If the language student is to receive a total linguistic experience the computer must be used in conjunction with other sources of instruction such as a teacher. Nevertheless, it has proven itself successful as an exclusive source of instruction for the teaching of rather obscure or literary languages for which only a reading knowledge is desired. Just such an application is found in the teaching of Armenian at Stanford (Carlsen, 1979) or Biblical Greek at the University of Toronto (Hurd, 1978).

Another possibility is to use the computer as the sole source of exposure to new material for certain areas of instruction only—for example, grammar presentation (Clausing & Wood, 1974), syntax (Decker, 1976), theoretical phonetics, or vocabulary. With this application the computer assumes entire responsibility for the aspects of the course for which it is best suited, leaving areas such as composition, translation, conversation, stylistics, and verbal competency to the teacher in the classroom and the language laboratory facilities.

A third possibility is to limit the use of the computer to an adjunctive role in which it merely serves to reinforce or test material presented elsewhere. This application is useful for providing additional drill and practice to weaker students and testing for students of all

levels. If a great many institutions seem to have chosen the adjunctive route (Allen, 1971; Marty & Myers, 1975; McEwen, 1977; Taylor, 1979; Kidd & Holmes, 1980) it should not necessarily be taken as an indication of the superiority of this type of use.

Pedagogical considerations are unfortunately not the sole determinants of the role of the computer. An all-important determining factor in the implementation of any CAL system is the availability of funds for the acquisition of computer equipment. The number of machines at the teacher's disposal will probably ultimately decide the role of CAL in the curriculum. Although evidence would seem to indicate (Lower, 1976; Taylor, 1979) that in order for students to obtain maximum benefits the computer should be a compulsory, integral part of the course, this is impossible to implement if sufficient numbers of machines cannot be provided.

Human Factors

According to the results of a survey conducted in 1971-72 it was revealed that faculty attitudes would be the second most important factor—the first being funding—that would determine the adoption of CAL (Rockart & Fralick, 1975). A more recent study conducted in 1976 indicated that although 80% of the 300 faculty members polled felt that CAL would enhance remedial instruction, they would nevertheless resist widespread use in education because they felt it could not replace interaction with students and would therefore be detrimental (Alderman & Mahler, 1977). Olsen's survey, mentioned earlier, revealed that some language teachers had even stronger feelings against the computer (Olsen, 1980). Certain colleagues who have demonstrated our CLEF materials to members of their school staff have been disappointed by the apparent apathy of some.

In our view, an instructor contemplating the implementation of a CAL system cannot reasonably expect an overabundance of support from his colleagues, who might well harbour feelings of scepticism and mistrust towards the computer and those who promote it. Certainly the greatest opposition will be shown if there is a direct attempt to alter his classroom teaching and his regular, everyday interaction with students. As language teachers, we may well see an analogy with the language laboratory. The language laboratory has, in the main, survived only as an adjunct to regular classroom activities.

The majority of language teachers are quite happy to co-exist with the laboratory just as long as it does not infringe upon their "territory". There is every reason to suspect that their reaction to the computer will be the same.

Such realities should not deter us from attempting to implement a CAL system; rather, it should avert us to the possible dangers of an overenthusiastic frontal assault on the educational system. Such assaults usually harm rather than help the cause. To our mind, the implementation should be gradual, and initially, perhaps, limited to one's own sphere of influence—i.e. one's own students, one's own classroom. If the experiment is successful, we will not need to convince others—our students will do it for us.

REFERENCES

Alderman, D.L., & Mahler, W.A. Faculty acceptance of instructional technology: attitudes towards educational practices and computer-assisted instruction at community colleges. *Programmed Learning and Educational Technology*, 1977, *14*, 77-91.

Allen, J.R. ELSE at Dartmouth: an experiment in computer-aided instruction in French. *French Review*, 1971, *46*, 902-12.

Carlsen, B. Computers programmed to teach foreign languages. *New York Times*, April 3, 1979, p. 5.

Clausing, G., & Wood, C. The computer-tutor in media-aided language programs. *NALLD Journal*, 1974, *8* (3), 11-20.

Collett, M.J. Examples of applications of computers in modern language study. 1: The step-wise development of programs in reading, grammar and vocabulary. *System*, 1980, *8* (3), 195-204.

Decker, H.W. Computer-aided instruction in French syntax. *Modern Language Journal*, 1976, *60* (5-6), 263-67.

Farrington, B. Computer-based exercises for language learning at university level. Paper presented at CAL 81, University of Leeds, 1981.

Holmes, G. A contextualized vocabulary learning drill for French. *Computers and the Humanities*, 1980, *14*, 105-11.

Holmes, G., & Kidd, M.E. "Serving Learner Needs: From Teletype to Micro," *Proceedings of the 11th Ontario Universities Computing Conference*, Kingston, 1980, 139-147.

Hurd, J.C. Computer-assisted learning at Trinity College. *University of Toronto Computernews*, 1978, *156*, 1-4.

Kidd, M.E., & Holmes, G. CAI for language remediation at the university level. *Proceedings of the Fourth Western Educational Computing Conference*, San Diego, 1980, 141-46.

Lower, S.K. Making CAL make a difference in College teaching. Paper presented to the NATO Advanced Institute on Computers in Science Education, Louvain-la-Neuve, Belgium, 1976.

Marty, F., & Myers, M.K. Computerized instruction in second-language acquisition. *Studies in Language Learning*, 1975, *1* (1), 132-52.

McEwen, N. Computer-assisted instruction in second language training: an Alberta project. *Canadian Modern Language Review*, 1977, *33* (3), 333-43.

Moursund, D. Microcomputers will not solve the computers-in-education problem. *AEDS Journal*, 1979, *13* (1), 31-39.

Olsen, S. Foreign language departments and computer-assisted instruction: a survey. *Modern Language Journal*, 1980, 64 (3), 341-49.

Rockart, J.F., & Scott Morton, M.S. *Computers and the learning process in higher education*. New York: McGraw Hill, 1975.

Taylor, H.F. DECU/TUCO: a tutorial approach to elementary German instruction. *Foreign Language Annals*, 1979, *12* (4), 289-91.

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